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P-T evolution of kyanite eclogite from the Pirin Mountains (SW Bulgaria): implications for the Rhodope UHP Metamorphic Complex

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A new finding of kyanite eclogite in the Pirin Mountains of southwestern Bulgaria is presented, within the rocks belonging to the Obidim Unit of the Rhodope Metamorphic Complex. This eclogite provides important information about the peak-pressure conditions despite strong thermal overprint at low pressure. Textural relationships, phase equilibrium modelling and conventional geothermobarometry were used to constrain the metamorphic evolution. Garnet porphyroblasts with inclusions of omphacite (up to 43 mol % Jd), phengite (up to 3.5 Si p.f.u), kyanite, polycrystalline quartz, pargasitic amphibole, zoisite and rutile in the Mg-rich cores (XMg = 0.44-0.46) record a prograde increase in P-T conditions from ∼2.5 GPa and 650° C to ∼3 GPa and 700-750°C. Maximum pressure values fall within the stability field of coesite. During exhumation, the peak pressure assemblage garnet + omphacite + phengite + kyanite was variably overprinted by a lower pressure one forming symplectitic textures, such as diopside + plagioclase after omphacite and biotite + plagioclase after phengite. The development of spinel (XMg = 0.4-0.45) + corundum + anorthite assemblage in the kyanite-bearing domains at ∼1.1 GPa and 800-850°C suggests a thermal overprint in the high-pressure granulite facies stability field. This thermal event was followed by cooling at ∼0.8 GPa under amphibolite facies conditions; retrograde kelyphite texture involving plagioclase and amphibole was developed around the garnets. Our results add to the already existing evidence for UHP metamorphism in the Upper Allochthon of the Rhodope Metamorphic Complex like in the Kimi Unit and show that it is more widespread than previously known. Published age data and field structural relations suggest that the Obidim Unit represents Variscan continental crust involved into the Alpine nappe edifice of the Rhodopes and that eclogite facies metamorphism was Palaeozoic, in contrast to the Kimi Unit where age determinations suggest a Jurassic or Cretaceous age for UHP metamorphism. This implies that UHP metamorphism in the Upper Allochthon of the Rhodopes may have occurred twice, during Alpine and pre-Alpine orogenic events, and that two independent HP/UHP provinces of different age overlap in this area.